



Environmental Energy Technologies Division

Lawrence Berkeley National Laboratory

State of the PV market in the US

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December 5th 2012 CEC NSHP staff workshop

For offering comments and/or assistance, thanks to Ted James, Alan Goodrich and Kristen Ardani (NREL), as well as Minh Le (U.S. DOE). This analysis was funded by the Solar Energy Technologies Program, Office of Energy Efficiency and Renewable Energy of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

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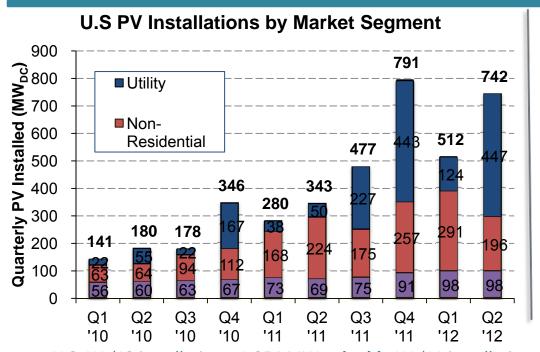


- Overview of recent US PV market developments
 - Capacity additions
 - Price development
 - Comparison of PV prices and technology on new homes vs. retrofits
- International experiences and opportunities for further cost reductions in the US
 - Bottom-up cost analysis of residential PV systems in Germany and the US

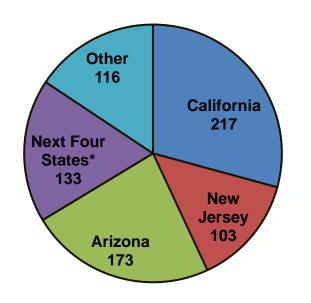
U.S. Installation Breakdown

(Source: David Feldman, Robert Margolis, NREL)





U.S. PV Installations by State (MW $_{\rm DC}$), Q2 '12



- U.S. H1 '12 installations: 1,254 MW double H1 '11 installations
 - GTM & BNEF forecast 2012 U.S. installations to reach 2.9 GW 3.3GW
- CA had largest quarter ever, driven in large part by Utility sector
 - BNEF expects future growth in the CA market to come from utility-scale PV demand, driven by FiT program, and Renewable Auction Mechanism, for next 3 years
- CSI is nearly depleted. Uncertainty as to how this will effect residential market (lower prices and/or less build)
- Non-residential installation market declined in many states, partially due to decreasing SREC prices

^{* &}quot;Next Four States": NV, TX, IL, NC

Installed Prices Continued Their Precipitous Decline in 2011



Median installed prices fell by \$0.7-0.9/W (11-14%) from 2010 to 2011, across the three size ranges shown, and have fallen by an average of 5-7% annually since 1998

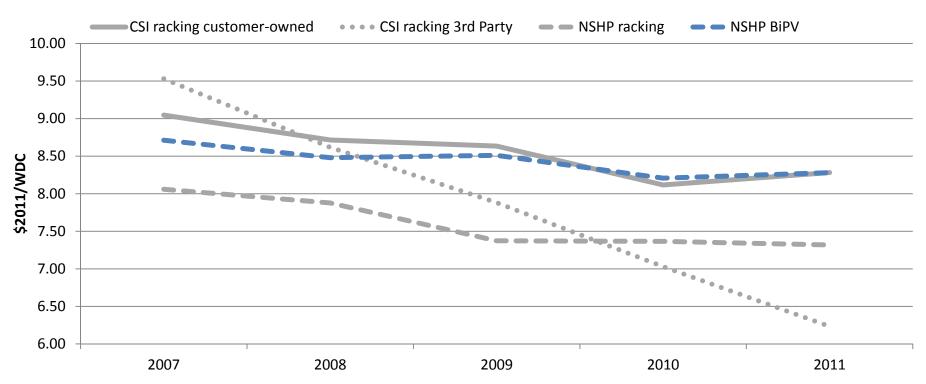


Small PV projects on new homes are cheaper in comparison to traditional retrofits...



... but more expensive than some 3rd party owned systems

Median Prices for PV 2-3kW Retrofit vs. New Construction in California



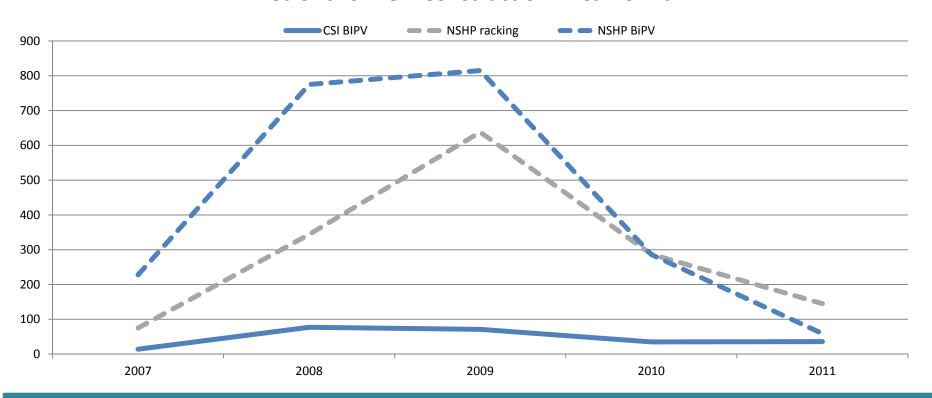
Note: 3rd Party systems only include systems for which a transaction price was paid and exclude "appraised values"

Building-integrated PV projects became less popular during the downtown of the new housing market...



... but are still more common than in the regular retrofit market.

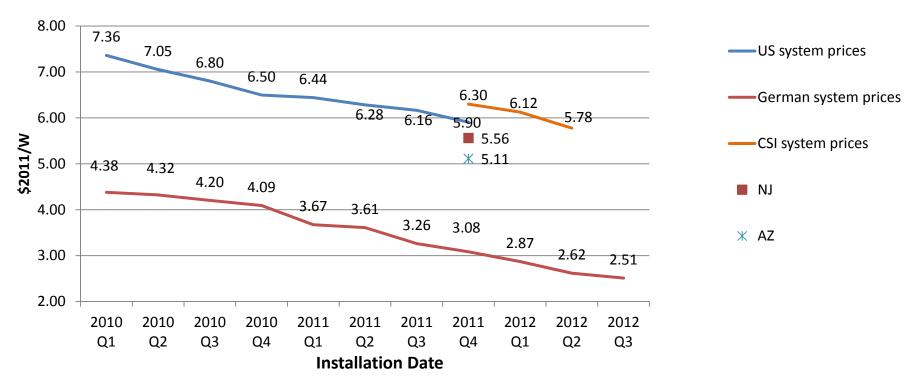
Count of building-integrated and rack-mounted PV systems <=10kW Retrofit vs. New Construction in California



German residential PV systems are \$2.50-\$3.00/W cheaper than US systems



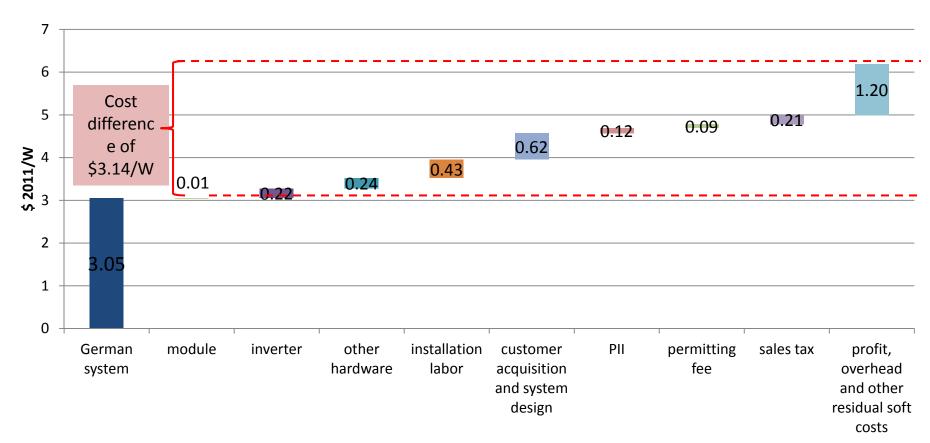
Median Installed Price of Customer-Owned PV Systems ≤10 kW*



^{*}Note: German system prices are available based on the date of price quote, rather than by installation date. However, the average time lag between price quote and installation date is much shorter in Germany than in the US., as described further within the secondary analysis

Breakdown of Cost Differential Between German and U.S. Residential PV in 2011 (customer-owned systems)





Notes: "Profit, overhead, and other residual soft costs" is calculated as a residual term based on the difference between total soft costs and the sum of the individual business process costs quantified through the German and U.S. installer surveys. This residual term includes such items as property-related expenses (rent, utilities, etc.), inventory-related costs, additional insurances and fees, and general administrative costs.



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Thank you for your attention

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Renewable Energy Analysis by the LBNL Electricity Markets & Policy **Group:**

http://emp.lbl.gov/research-areas/renewable-energy

Detailed price study on PV in the US: Tracking the Sun V:

http://emp.lbl.gov/publications/tracking-sun-v-historical-summary-installed-price-photovoltaics-unitedstates-1998-2011

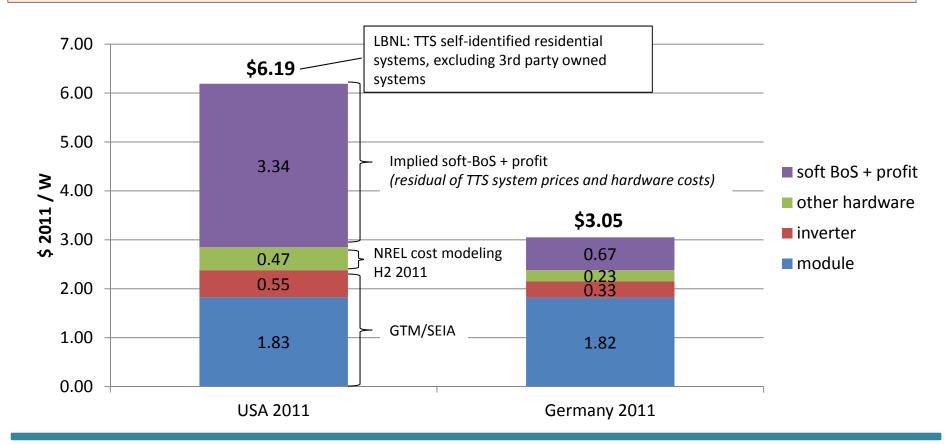
Cost comparison study between German and US systems:

http://emp.lbl.gov/publications/why-are-residential-pv-prices-germany-so-much-lower-united-statesscoping-analysis

Soft Costs for Residential PV in Germany Are ~\$2.7/W Lower Than in the U.S.



Total soft costs for residential PV in Germany, including margin, are just 22% of the implied soft costs for U.S. residential PV (\$0.67/W vs. \$3.34/W)



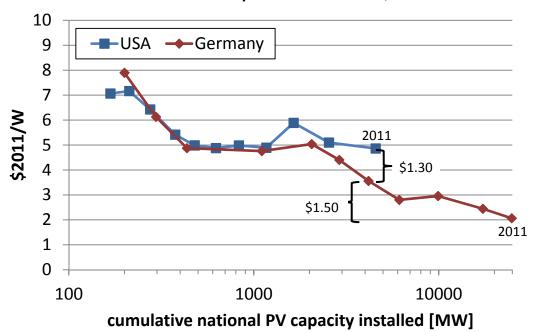
^{*} Notes: US module and inverter prices are based on average factory gate prices for Q4 2010-Q3 2011 as reported by GTM/SEIA with an adder of 10% to account for supply chain costs. Inverter efficiency assumed to be 85%.

Differences in Market Size Alone <u>May</u> Explain Roughly Half of the Price Gap



Implied Average Annual Non-Module Costs* vs. Cumulative Capacity:

Customer-Owned Systems ≤10 kW, 2001-2011



* **Note:** Implied average annual non-module cost = average annual system price minus global average factory gate module price

- Total non-module costs in 2011 were ~\$2.8/W higher in the U.S. than in Germany
- But, at the same cumulative capacity that the U.S. had installed at the end of 2011 (4 GW), non-module costs for residential PV in Germany were only \$1.3/W less than in the U.S.
- One might (crudely) infer that the remaining \$1.5/W of the total gap in 2011 non-module costs may be due simply to the larger base of German experience

U.S. System Prices are derived from LBNL's TTS dataset and are equal to the median of customer-owned systems ≤10kW installed in each year. **German System Prices** are the averages of individual price quotes in EuPD's dataset (2008-2011) or the average of prices reported by IEA, Photon, KfW, and Schaeffer (2001-2007).

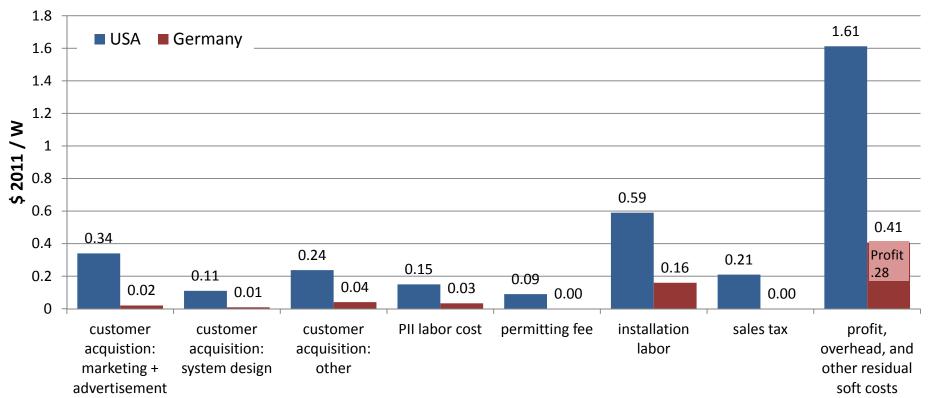
Module Factory-Gate Prices are the average of prices reported by IEA, GTM, IRENA, Navigant, and Photon (annual currency exchange rates were used for module prices estimates)

Summary of Soft Cost Differences for Residential PV in the U.S. and Germany



Comparison of Soft Costs for Residential PV in Germany and the U.S.

(customer-owned systems)



Notes: "Profit, overhead, and other residual soft costs" is calculated as a residual term based on the difference between total soft costs and the sum of the individual business process costs quantified through the German and U.S. installer surveys. This residual term includes such items as property-related expenses (rent, utilities, etc.), inventory-related costs, additional insurances and fees, and general administrative costs.